

Roon Labs Nucleus+ music server

 [stereophile.com/content/roon-labs-nucleus-music-server](https://www.stereophile.com/content/roon-labs-nucleus-music-server)

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2018



Ssssshhhhh

This was the second time the Mac mini had died. The first time, in 2015, the local Apple Genius Bar had repaired it. This time, the hipster at the Genius Bar turned me away: "We don't offer repair work on *vintage* computers."

But I'd become addicted to the Roon app. The loss of its host computer was almost an existential crisis.

Vintage Computers

In 1967 I had a summer job working in an electronics lab. Whenever we had a problem that needed to be worked out on a computer, we would present it to a gentleman in a white coat, who would code the problem on punch cards, then disappear into an air-conditioned room to which we "civilians" were barred entry. A few days later, I would receive a printout of the result. That was my first experience of working with a computer.

In 1981, I bought a kit from which to construct a Sinclair/Timex ZX81 computer. Housed in a small plastic case with a plastic-membrane keyboard, the ZX81 was based on a Zilog Z-80 8-bit microprocessor chip and came with 1kB of RAM, which I upgraded to 16k in order to run larger programs that I'd bought or written in the ZX81's BASIC language. That was my second experience of working with a computer.

In 1983, I bought a BBC Micro Model B, which used an MOS Technology 6502 8-bit microprocessor, had enough RAM to be useful, and could be used with 5½" floppy diskettes. I wrote programs in both BASIC and machine code; by 1985, using a tagged

text language I'd written, I was producing on the Beeb most of the editorial content for *Hi-Fi News & Record Review* magazine. That was my third and formative experience of working with a computer.

But becoming involved at such a deep level in personal computing required way too much time. Over the years since the 1980s, particularly when it came to using a computer as an audio server, I've been working with ready-made solutions, the [Antipodes DX Reference](#), [Aurender N10](#), and [NAD Masters Series M50.2](#) in which all the heavy lifting of optimizing a general-purpose computing system to work as a dedicated server for playing audio files has already been done.

Yes, I've recently been tempted by the introduction of low-cost computer-on-a-board systems such as the Raspberry Pi, the various Arduinos, and Intel's NUCs but there's that time-sink problem again. The closest I got to rolling my own server was installing Roon on my Mac mini and you know how that worked out.

Fortuitously, soon after my return from Apple's Genius Bar, Roon Labs' Steve Silberman called to let me know that the company was about to release its first hardware product, the Nucleus+ server. Would I be interested in a review sample?

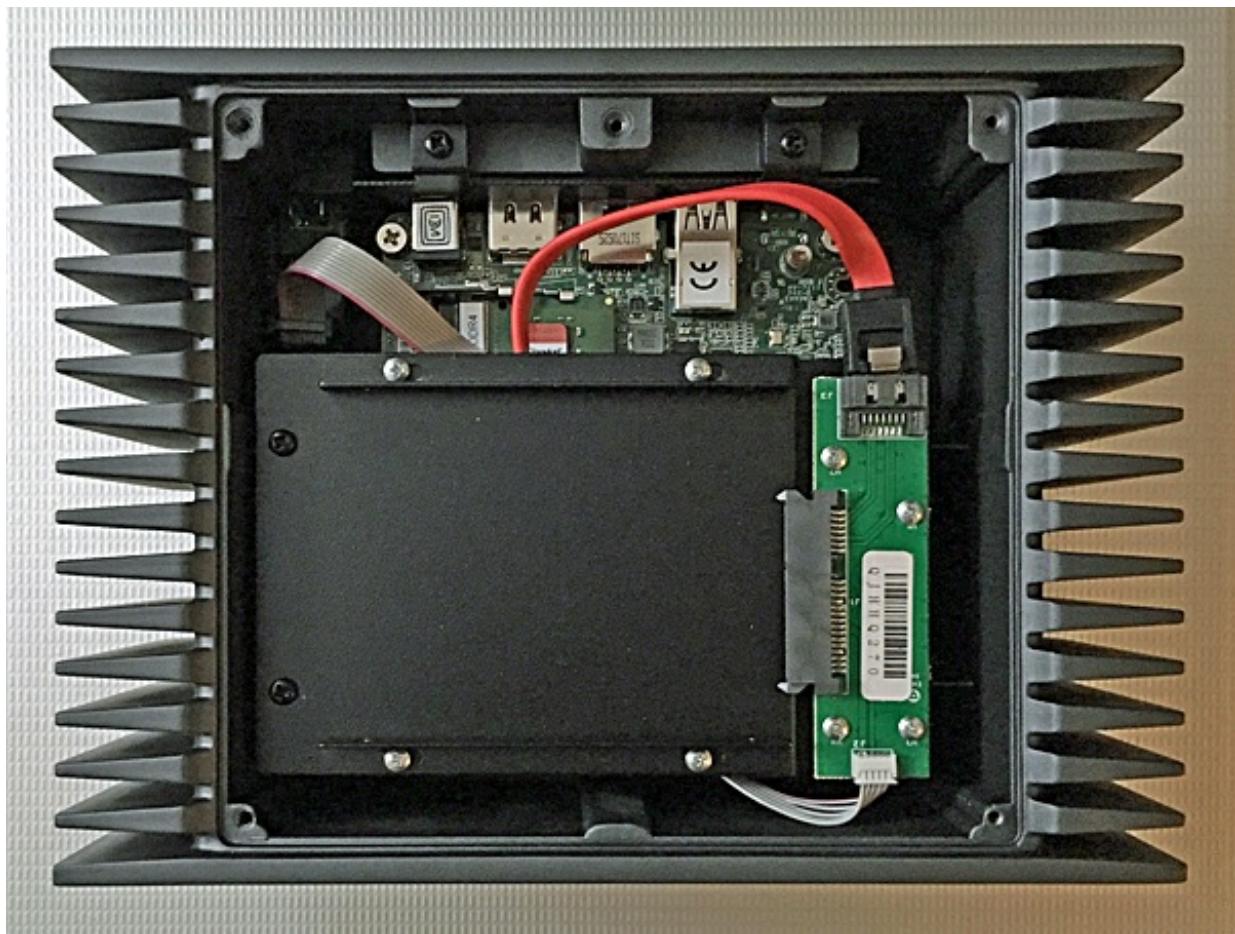
I would indeed!

Enter the Nucleus+

Roon's COO, Danny Dulai, visited in late February, bringing with him a Nucleus+. Priced at \$2498, this uses an Intel i7 processor/NUC board and has 8GB of RAM and a 64GB SSD solid-state drive. The basic Nucleus costs \$1398 and uses an i3 processor with 4GB RAM and a 64GB SSD. Both Nucleuses have a single gigabit Ethernet port, two USB 3.0 ports that can be used both to connect external drives and to feed data to a USB DAC, an HDMI port that can be used for both stereo and multichannel audio, and a Thunderbolt 3 port, so far unused. The Nucleus+ can output audio data simultaneously to more than six zones, one of which can be the iPad running the app. The Nucleus can cope with six zones.



The internal drive is not used to store audio files. Instead, as well as hosting the Roon Optimized Core Kit (ROCK) operating system and the Roon server software, it's used to manage Roon's library (footnote 1). From the outset, Roon was intended to produce a rich metadata experience. From the moment you point the Nucleus Core to the location of your audio library, the system begins to create the waveform display for every track; starts scouring the Internet for metadata, artwork, biographies, and reviews; and builds an object database. This means, says Roon, that "instead of storing data in the traditional tabular form, we model your music as a web of interconnected entities and their relationships to one another. . . . They enable us to perform complex queries that would be impractical for a traditionally architected application, and they let us perform background processing on your music library in order to continually improve the user experience."



The basic Nucleus's 64GB SSD can handle the metadata for libraries of up to 12,000 albums or 120,000 tracks; the Nucleus+'s SSD can cope with libraries with more than 12,000 albums/120,000 tracks. I thought I had a reasonably large library; Roon tells me I have 20,565 tracks. The Roon app asks you for a backup location for the library's metadata. After three months of using the Nucleus+, my backup has filled 2.4GBit's going to be a while before the internal 64GB SSD is full!

Listening

To use the Nucleus servers you'll need a subscription to Roon (free 14-day trial, \$119/year, \$499/lifetime, footnote 2). I began my auditioning of the Nucleus+ with v.1.4 of the Roon app running on my iPad mini, and v.1.4 of the Roon Core and v.1.0 of the Roon OS running on the Nucleus+. Toward the end of the review period, both app and Core were updated to v.1.5, which allows the unfolding of MQA-encoded files. Using the iPad app, I pointed the Roon Core to my library, initially stored on a 2TB USB drive.

Roon's metadata library continues to amaze me. The Radio function, akin to iTunes' Shuffle mode, digs deep into the data to find connections. It followed Robert Silverman's *Chopin's Last Waltz/* (DSD64 files, IsoMike 5606) with an MQA-encoded version of his recording of a Beethoven piano sonata. But who then would have anticipated it cueing up "Soul Intro/The Chicken," from the late bass guitarist Jaco Pastorius's *Truth, Liberty & Soul* (24/192 AIFF file, Resonance HCD 2027)? And Roon's ability to instantly discover a particular performance of a composition is frightening. While playing Henry Love's *Das alte Lied*, from pianist Stephen Hough's *Dream Album* (16/44.1k WAV, Hyperion CDA68176), I asked Roon what other performances there were of this work. It immediately responded that while there was just the one in my library, eight others were available from the Tidal streaming service.

While Roon supports PCM resolutions up to 24 bits, sample rates up to 384kHz, and DSD up to DSD128, it downsamples the data to match the limitations of the D/A converter in use. For example, my PS Audio DirectStream DAC is limited to PCM sampled at 192kHz via its Bridge II network adapter. Clicking on the colored dot to the right of the track name at the bottom of the Roon app's screen displays the signal path. With the Trondheim Soloists' performance of Kim André Arnesen's *Magnificat* (24/352.8k FLAC, 2L), the Nucleus first converted the 24-bit integer data to 64-bit floating point, then converted the sample rate from 352.8 to 176.4kHz, then the 64-bit float data to 32-bit integer, finally sending the 32/176.4 data to the Roon Ready PS Audio over the network using the Roon Advanced Audio Transport (RAAT), which Roon says "delivers bit perfect audio to local outputs, networked outputs, and Roon Ready devices." The processing speed was listed as "13.7x" ie, plenty of margin. Similarly with Christian Tetzlaff and Lars Vogt's performance of the Brahms Violin Sonatas (DSD128 files, Ondine ODE1284-2D/HDtracks), the Nucleus converted the sample rate from 5645 to 2822MHz, then applied a DSD64 sigma-delta modulator to the data before sending them to the PS Audio. This time, the more intensive processing cut the conversion speed to "3.8x."

iPad 10:21 AM 17%

Magnificat
Nidarosdomens Jentekor & Trondheim Solistene

Date Recorded: May 2013
Source: FLAC 352.8kHz 24bit
Length: 4 min
Range: 18

Choral

Tracks Credits Versions

4 Magnificat: Et misericordia

Performed May 2013 - May 2014, Nidaros Cathedral, Trondheim, Norway, by Trondheim Soloists (TrondheimSolistene) featuring Nidarosdomens Jentekor & TrondheimSolistene
Conducted by Anita Brevik
Composed by Kim André Arnesen

Signal Path: High Quality

Click on any stage of the path to learn more

psaudio •

Processing speed: 13.7x

Source FLAC
FLAC 352.8kHz 24bit 2ch

Bit Depth Conversion 24bit to 64bit Float

Sample Rate Conversion 352.8kHz to 176.4kHz

Bit Depth Conversion 64bit Float to 32bit

PS Audio DirectStream DAC Roon Advanced Audio Transport

Output Analog Output

Violin
IS

0 imSolistene

2:07 4:55

Magnificat: Et misericordia
Nidarosdomens Jentekor, Trondheim Soloists

psaudio 63

3:27 PM 37%

Sonata for violin & piano No. 2 in A major ("Thun"), Op. 100
Brahms: The Violin Sonatas

Performed by Christian Tetzlaff, Lars Vogt
Composed by Johannes Brahms

DSF DSD128 1bit 2ch

Queue 3 tracks remaining (18:53)

Now Playing

Violin Sonata No. 2 in A major, Op. 100: I. Allegro
Christian Tetzlaff, Lars Vogt

Signal Path: High Quality

Click on any stage of the path to learn more

psaudio •

Processing speed: 3.8x

Source DSF
DSF DSD128 2ch

Sample Rate Conversion 5.645MHz to 2.822MHz

Sigma-Delta Modulator DSD64

PS Audio DirectStream DAC Roon Advanced Audio Transport

Output Analog Output

Violin
IS

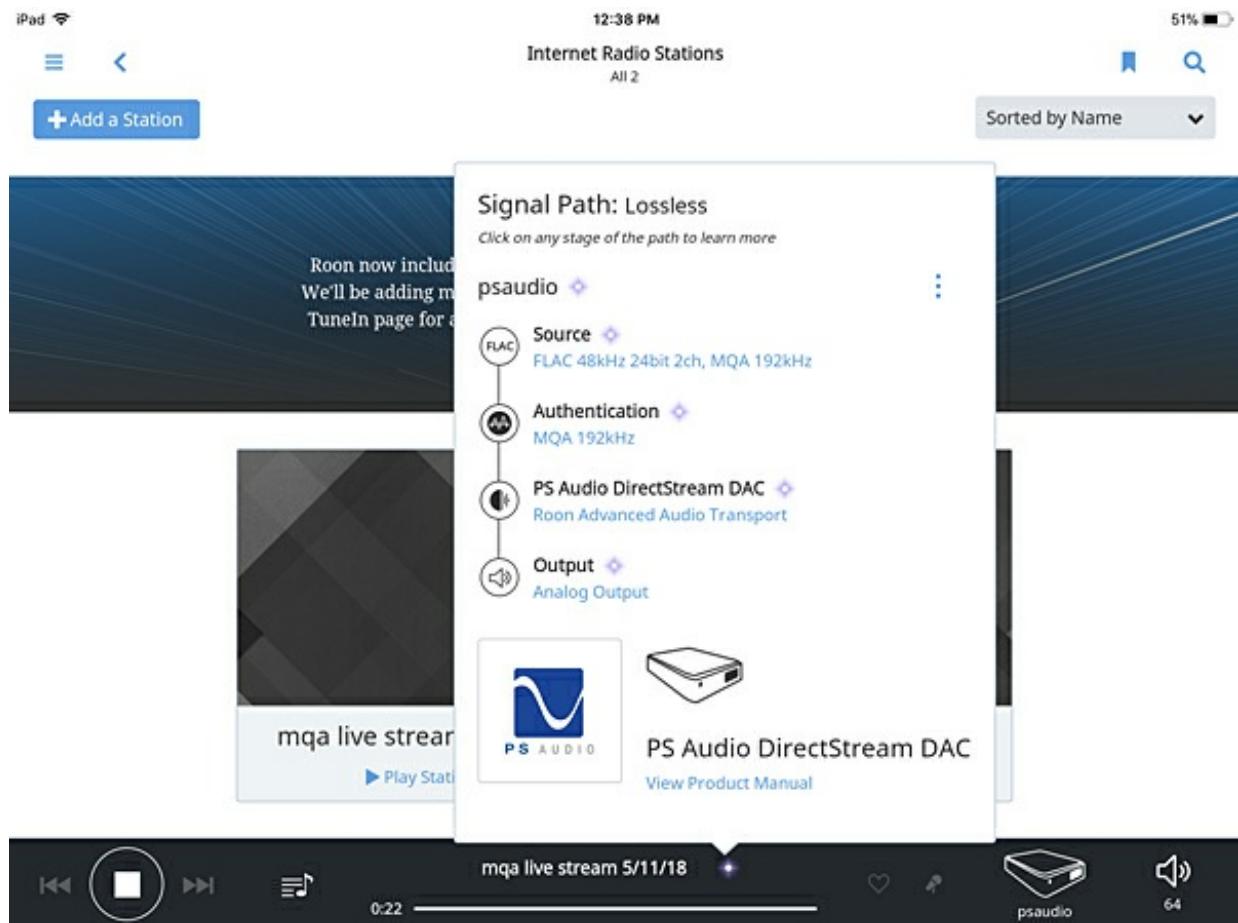
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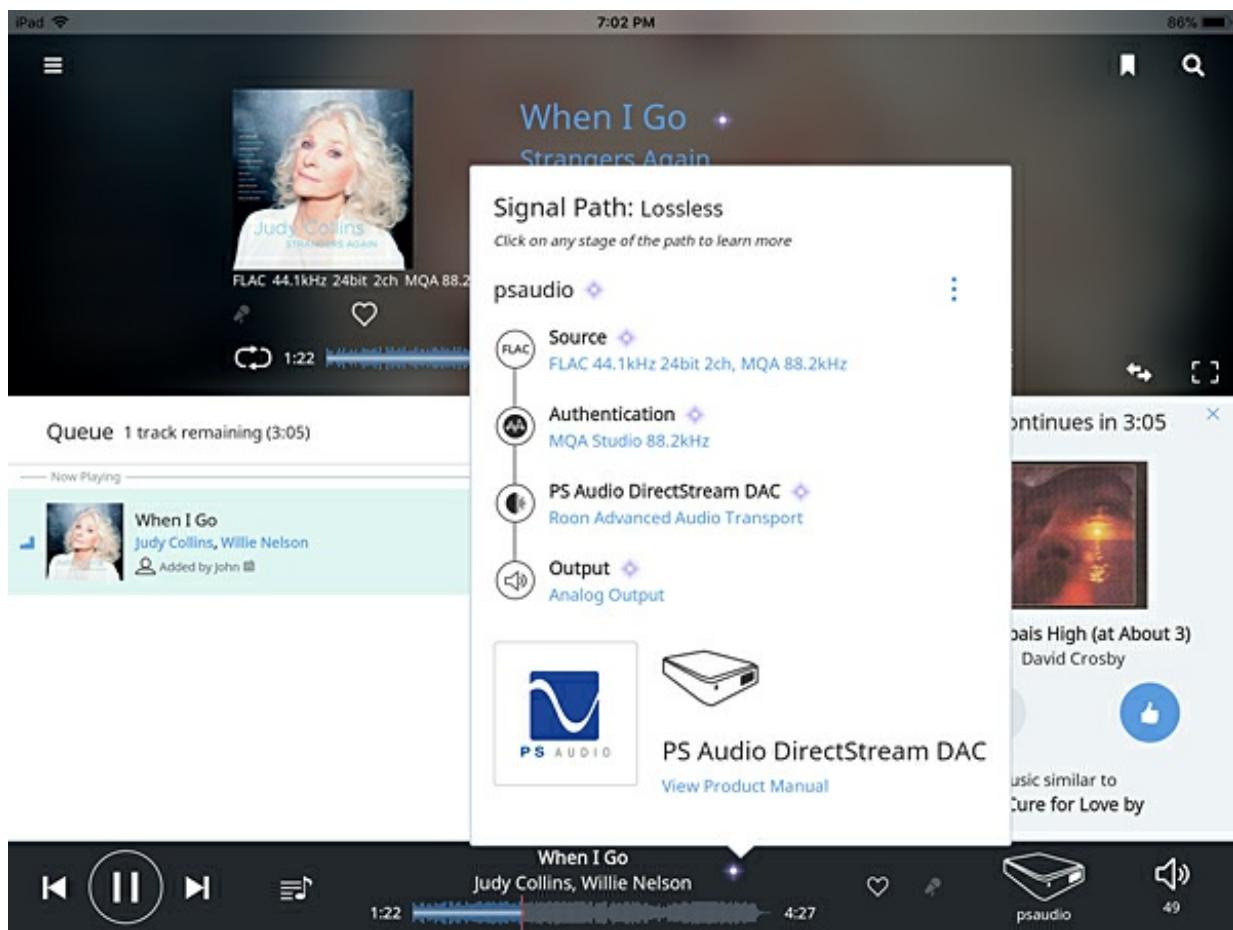
0:56 8:01

Violin Sonata No. 2 in A major, Op. 100: I. Allegro
Christian Tetzlaff, Lars Vogt

psaudio 64

With Roon 1.5, I used the Internet Radio Stations feature to access a live streaming event that MQA Ltd. had arranged to coincide with May's High End show, in Munich: a jazz sextet led by double bassist Misha Mullov-Abdado playing four songs in a London studio. Roon identified the stream as "FLAC 48kHz 24-bit, 2ch, MQA 192kHz," noted that Authentication was "MQA 192kHz," and used RAAT to send the data over my network to the PS Audio. The PSA's screen indicated that it was receiving data sampled at 192kHz, though the bit depth was indicated as "16 bits" rather than 24, apparently due to a bug in the PSA Bridge's firmware (since fixed).





You'll note that I've said nothing about sound quality. Having used the Nucleus almost every day since it arrived, I have nothing specific to say about the sound other than that it was always excellent. So . . .

Comparisons

I've written before that I've found that a DAC fed data via USB doesn't sound as "solid" as when the DAC is fed the same data via an AES/EBU link. I didn't listen to the Nucleus+'s USB output the server sits in a rack too far from the PS Audio DAC for a USB link to be practicable. But what about data sent from it via Ethernet, where the length of the link is immaterial? As I left Michael Fremer's place after measuring the Moon by Simaudio 888 amplifier reviewed elsewhere in this issue, he pressed on me the CD of Van Morrison and Joey DeFrancesco's *You're Driving Me Crazy* (Exile/Legacy 19075820041). Comparing a WAV file of "Like Young Lovers Do," sourced from the Roon over my network, with my

Ayre Acoustics C-5xe disc player via AES/EBU, it was difficult to hear any significant difference. Perhaps the Hammond organ's bass pedals were a bit fuller with the Nucleus+; perhaps the Ayre's output sounded a little more open. Perhaps.

Before introducing the Nucleus servers, Roon used to recommend Intel's NUC mini PCs. Jason Victor Serinus lent me his NUC7i7BH (\$469 in kit form). This takes longer to boot and from 3' away I could hear its cooling fan but it was then recognized by the Roon app as "Roon Optimized Core Kit." I pointed Roon to ROCK as the music source and enabled the PS Audio DAC as the audio device.



Who knew Jason would have the B-52's in his library? "Rock Lobster," sourced from Tidal and the NUC, had excellent impact, with good low-frequency extension. Streaming the same track from Tidal via the Nucleus+, perhaps there was a touch more authority in the bass. Perhaps. With "Every Day I Have the Blues," from the Morrison-DeFrancesco album, the sound through the NUC was less authoritative, less open. However, the comparison was unfair: Though both versions were 16/44.1, I was streaming from Tidal with the NUC, and playing a WAV file from local storage with the Nucleus+. Nevertheless, while changing to the Tidal stream with the Nucleus+ reduced the difference between the servers, the Nucleus+ sounded still a tad tidier.

Conclusion

For those who, like me, don't want to go the hair-shirt, DIY route to networked audio, the fit'n'forget functionality and routinely excellent sound quality of Roon Labs' Nucleus+ through both of the DACs I used it with make it an easy recommendation. It's not going back!
